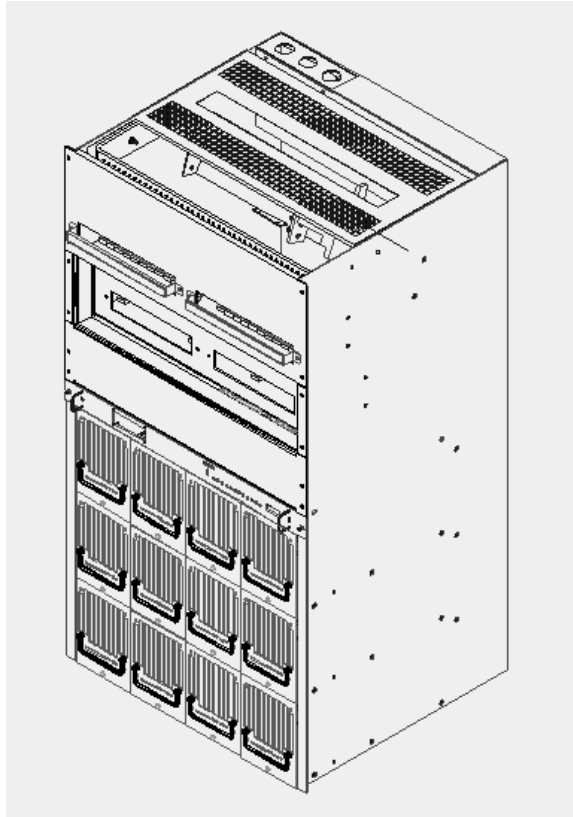


DC Power Plant Product Manual MX28B600



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APC DCNS Inc.
11035 Switzer Avenue
Dallas, TX 75238

REVISION HISTORY

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1. GENERAL INFORMATION

1.1 Introduction

DC Power Plants from APC DC Network Solutions Inc. (hereafter in this document “APC”) have unique features that make them easy to install, maintain, and upgrade. The rectifier units are modular and truly “hot-pluggable” into the shelf assembly without any separate AC wiring.

All system settings are made from the system control unit that provides monitoring and control functions for each component of the system as well as alarm listings for system diagnosis and maintenance.

The APC’s international network of sales and service offices and qualified representatives provides sales assistance for proposals, purchases, and after-sales support.

APC provides nationwide support 8am to 8pm EST. 8pm to 8am Emergencies only by leaving a message with a paging system by dialing:

(800) 800-4APC

This service will answer your call, gather specific service information, and have a qualified APC service representative contact you as quickly as possible (refer to section on customer service and support).

1.2 Precautions

It is extremely important to read, understand, and strictly follow the instructions in sections on installation and setup. Also, please note the special SAFETY PRECAUTIONS outlined in Section 5.1.4 before beginning actual installation of the power system.

If any precautions are not clearly understood, or local conditions are not covered, contact the nearest APC representative call us at 800-800-4APC for clarification.

Also, refer to all applicable federal, state, and local regulations, and industry guidelines for correct installation of this power system.

1.3 Inspection upon Receipt of Goods

1.3.1 General

APC has taken precautions in packing the power equipment for shipment to ensure its safe arrival; however, the entire shipment including any and all boxes or crates should be inspected upon receipt for evidence of damage that may have occurred during transit.

1.3.2 Visible External Damage

It is the responsibility of the person receiving the shipment to inventory and inspect all materials against the bill of lading or waybill provided **IMMEDIATELY** upon taking delivery while the carrier representative is **STILL ON SITE**. Please be sure that all items are accounted for, including the correct number of pallets and the quantity of all accessory and/or component boxes. Also, note any visible external damage that may have occurred during transit.

If damage has occurred or the quantity of items is not correct, then:

- 1) Make a descriptive notation on the delivery receipt before signing.
- 2) File a damage or shortage report with the carrier that delivered the shipment.

1.3.3 Concealed Damage

It is the customer's responsibility to unpack the power system and equipment received from APC and check for concealed damage, within 15 days of receipt of any and all materials. The customer is responsible to check the materials received against the detailed packing list to verify that the quantity and condition are complete and satisfactory.

Again, note any damage to the internal packing material, the equipment itself, and/or material or equipment shortages. If damage or shortage is noted, then:

- 1) Immediately request an inspection by the carrier;
- 2) File a concealed damage claim; and/or
- 3) File a material shortage claim with your APC representative.

DELAY IN NOTIFYING THE CARRIER MAY RESULT IN LOSS OF RIGHT TO REIMBURSEMENT FOR DAMAGES OR LOSS.

If you are unsure about the appearance of a part while conducting the materials inventory and inspection, refer to the manual or contact the Customer Service Department of APC.

Should you have any questions concerning potential damages or should you experience a lack of cooperation from your carrier, please contact your APC representative, or call APC.

1.3.4 Return of Damaged Goods

Should equipment be damaged and require return to APC for repair, the APC service representative will provide instructions along with a valid returned material authorization (RMA) number to facilitate return of the damaged goods to the APC repair center.

It is important that the steps outlined in Section 1.3.2 and Section 1.3.3 above are followed carefully. Your APC representative will assist you, if required, in obtaining proper disposition of an initial delivery return issue; however, a valid RMA number must be obtained before returning any equipment to APC.

2. CUSTOMER SERVICE AND SUPPORT

APC manufactures standby power plants and systems, and provides customers with complete product and systems support and service. APC has an international network of factory trained service technicians. The service organization is on call 24 hours a day, 365 days a year.

If there is a problem with the power system, contact APC DCNS at

1-800-800-4APC

When you contact APC you should refer to your supplier as DC Network Solutions. Units returned for repair can usually be turned around within 24 to 48 hours of receipt at the factory location. Shipment should be sent pre-paid. The unit will be returned pre-paid provided it was received that way.

An RMA must be obtained for all equipment returned to APC. It is important that correct procedures be followed in filing an RMA, including providing an accurate written description of the problem. An accurate written problem description will help ensure that the unit will be properly repaired in a timely manner.

If a unit is returned and a “No Fault Found” results, APC reserves the right to bill the customer for labor and assess a service charge to recover the costs incurred.

3. WARRANTY PROVISIONS

3.1 General Provisions

APC DC Network Solutions Inc. warrants the power equipment and components it manufactures or sells against defective materials and workmanship for a period of TWO (2) YEARS from the date of shipment.

3.1.1 Warranty Returns

If initial physical inspection results in identification of a material or workmanship flaw(s) that could impair product performance, as defined by APC's electrical and physical specification in effect at the time of shipment, and if this flaw(s) is not due to transportation damage or installation abuse, contact APC at 1-800-800-4APC, to request assistance.

You will be provided either; a) an RMA number with instructions for return of the equipment or component(s) to the APC factory service center, FOB destination, freight pre-paid, for examination; or b) for non-returnable systems and equipment, notice to wait until an APC authorized service representative arrives at the site to inspect the equipment. Repaired or advance replacement modules or circuit components will normally be available within 24 to 48 hours of receipt of returned equipment or repairs and/or equipment adjustments will be performed by APC service representatives at the site. APC reserves the right to determine the method for correction of equipment flaw(s).

3.1.2 Warranty Repair or Replacement

If, during the warranty period, the supplied equipment is found to be physically or electrically faulty due to defective materials or workmanship on the part of APC, the defective product(s) or component(s) will be repaired or replaced at the sole option of APC without charge to the user for replacement materials or repair labor. (The procedure outlined above for contacting APC must be followed.) Costs incurred for replacement installation including, but not limited to, installation equipment, travel expenses of an APC representative(s), and costs for installation material transportation expenses are not the responsibility of APC. Any replacement product(s) or component(s) shall only complete the remaining unused portion of the original warranty of the replaced product(s) or component(s).

3.2 Exclusions and Limitations

1. This warranty applies only to the original US domestic purchaser (user) and is not transferable internationally, except with expressed written consent from APC.
2. APC reserves the right to void the warranty if identification marks or serial numbers have been removed or tampered with, or the defect is determined to have been caused by misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration, or accident.
3. This warranty does not cover physical damage due to the acts of nature or man that stress the equipment or component(s) beyond design limits and exert undesirable influence aside from normal wear and tear.
4. APC assumes no responsibility for any work performed, or expenses incurred, except with expressed written consent from APC.

5. APC shall not be liable to the user (purchaser), or any third party, for indirect, incidental, or consequential damages such as, but not limited to, loss of use, loss of profits, costs associated with removal/installation of a defective product(s) or component(s) arising out of the sale or relating to the use of this product; and the user (purchaser) assumes all responsibility for all personal injury and property damage resulting from the handling, possession, or use of the product. In no event shall the liability of APC for any and all claims, including claims of breach of warranty or negligence, exceed the purchase price of the product that gave rise to the claim.

The above warranty is in lieu of all other remedies, including actions for contract or negligence.

All other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are hereby excluded.

4. PRODUCT OVERVIEW AND TECHNICAL DESCRIPTION

4.1 Description

The MX28B600 is a modular stand-alone -48V DC power plant with a microprocessor-based control unit. It is configurable in such a manner that it will support most typical applications within the specified current range of 600 amperes without special application engineering or assistance. Distribution of two tiers is included for up to 44 plug-in circuit breakers, located in a 24-position panel (breakers labeled 1 to 23) and two 10-position panels (breakers labeled 25-34 and 39-48), all with front access. These circuit breakers can be 1 to 100 amps, with 60-100 amp breakers requiring two positions and a circuit breaker adapter kit.

An optional low voltage disconnect (LVD) can be provided on either the battery or the load side.

Optional load shedding capabilities can also be provided by use of an additional LVD that will disconnect loads connected to the lower right breaker panel at a user specified voltage.

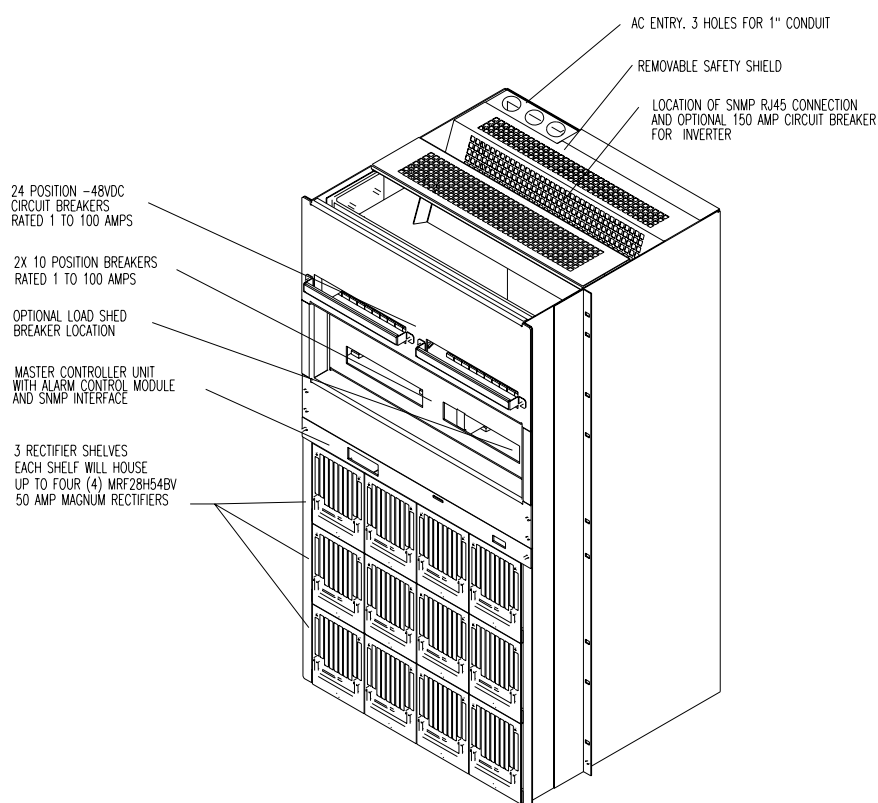


Figure 4.1-1. MX28B600

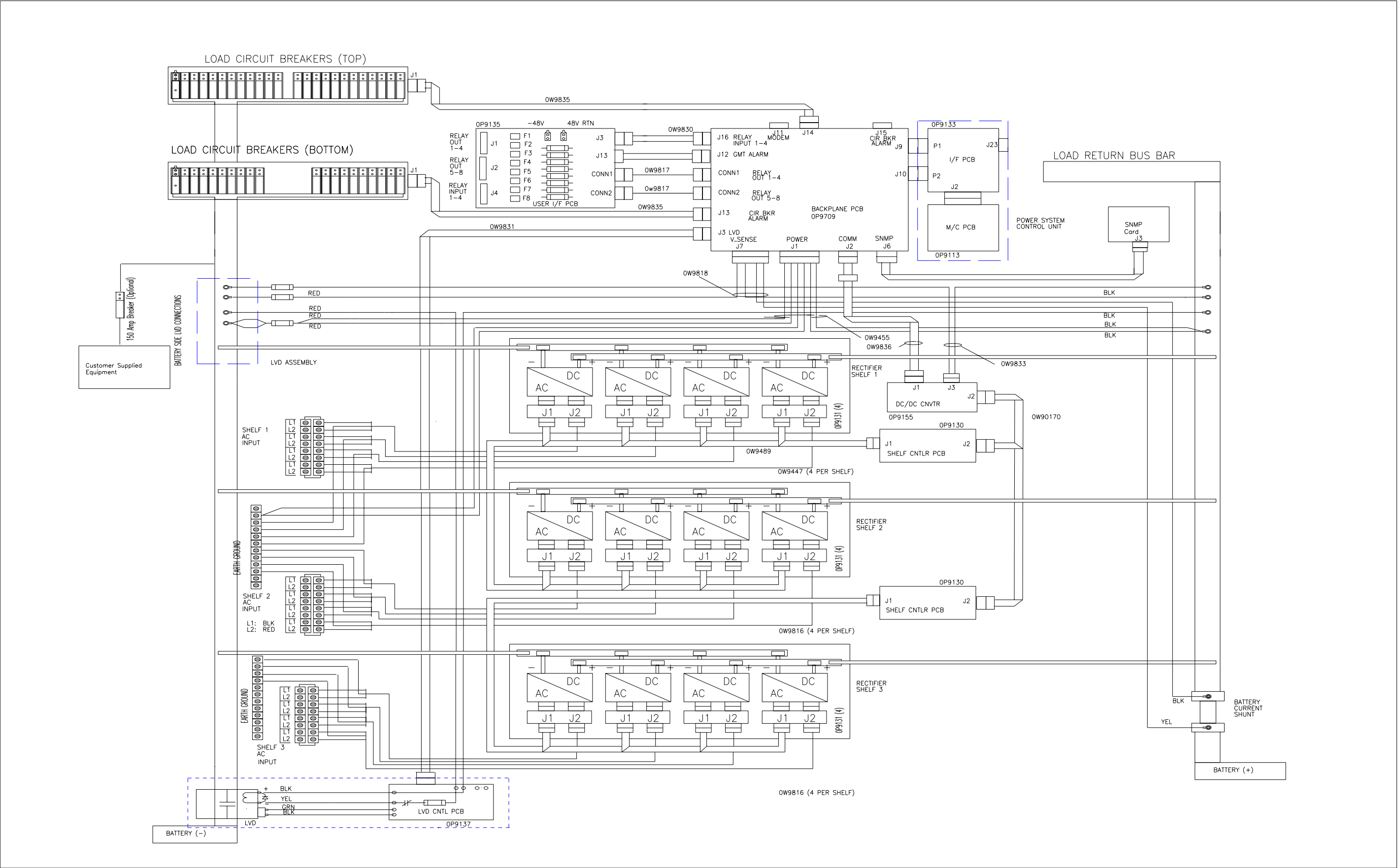


Figure 4.1-2. MX28B600 BLOCK DIAGRAM

4.2 Power Output Capacity

600 amps maximum, or 550 amps with N+1 redundancy. The housing provides space for three rectifier shelves that can hold up to four rectifiers each, a control unit, and two tiers of up to 43 distribution circuit breakers.

4.3 Rectifiers

The rectifiers are APC DC Network Solutions, Inc. Model MRF28H54BV with specifications as follows:

- Input Voltage: 176-264V AC (230V AC nominal) @ 45-66 Hz
- Input Current per Rectifier: 13.9 Amps @ 230V AC
- Apparent Power Factor: 99% Typical, 98% Minimum
- Output Voltage: 54.5V DC
- Over voltage Protection: Set at 59.5V DC
- Output Current per Rectifier: 50 Amps Minimum Continuous
- Power Output per Rectifier: 2800W Continuous, $V_{in} > 198V$ AC
- Efficiency: 91% Typical
- Cooling: Fan cooled, front to rear airflow
- Ambient Temperature: -25°C to 65°C Operational
- Hostile/Dusty Environment: Dust filter is optional

4.4 Control Unit

The microprocessor-based power system control unit is 1U high (1.75”) and provides control and monitoring functions. Operating features are:

- 32-character alphanumeric display
- LED alarm and status indicators
- Standard voltage and battery charging control
- Battery temperature compensation (optional)
- Monitoring of up to three shelves of four rectifiers each
- Individual alarm monitoring of 43 breakers
- Individual alarm monitoring of eight GMT fuses
- Eight alarm / annunciation relays (Major, Minor, and six user defined) with form C contact outputs
- Four external alarm inputs (either N.O. or N.C. contacts)
- Control of either a battery or a load LVD
- WEB/SNMP interface card for remote monitoring.

4.5 AC Input Power

Each rectifier requires 208/220/240V AC, single-phase, 50/60 Hz, supplied through an external 20-amp two-pole breaker. There are three entry points (one for each rectifier shelf), for customer-supplied one-inch conduit. Section 5.2 for details on electrical connection.

4.6 Battery connections

Battery connections are made by feeding the cables thru the bottom-rear of the unit. Use caution when running the cables to not damage other components. (Figure 4.6-1). The -48V and return buses each provide two sets of threaded 3/8"-16 holes on one-inch centers for connecting two-hole battery cable lugs.

A manual battery disconnect breaker is included in the equipment housing at the top right circuit breaker position in the front panel.

Battery temperature compensation is available. APC's standard temperature monitor sensor and cable is used to implement this optional function.

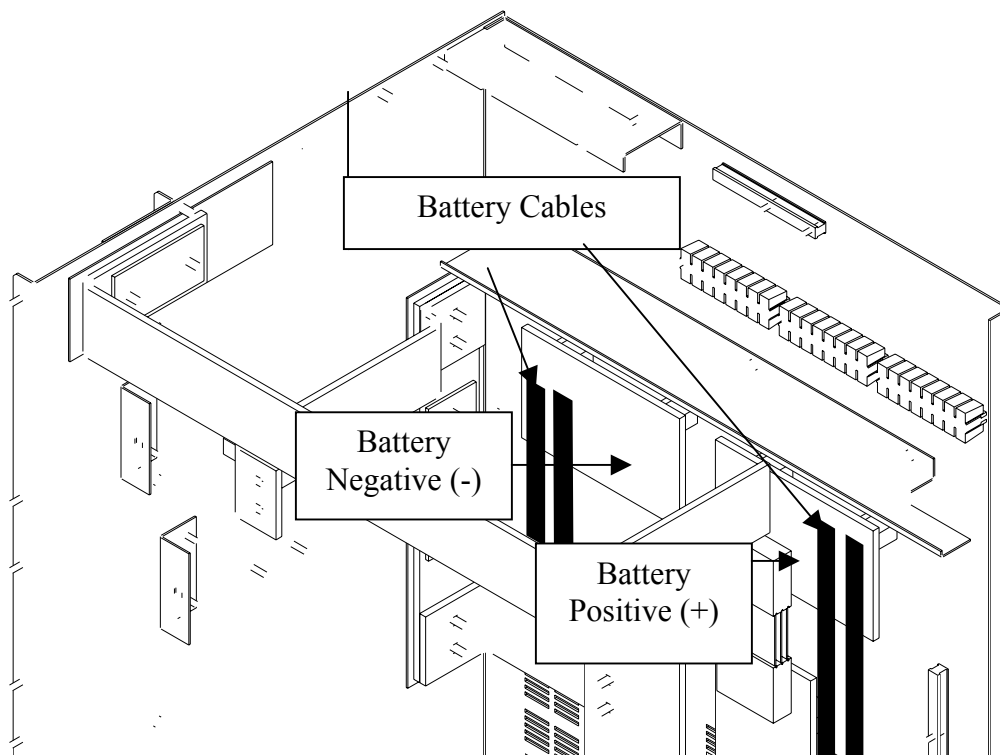


Figure 4.6-1. Battery Cable Connection Locations

4.7 DC Distribution

Two plug-in circuit breaker tiers, consisting of a 24-position panel and two 10-position panels, provide 43 positions of -48V distribution. One position is reserved for the Manual Battery Disconnect Switch. The breaker tiers are center fed via bus bars to the -48V DC bus with each side having an ampacity of 300A.

Connections for -48V DC loads, requiring standard #10-32 two-hole lugs on 5/8-inch centers, are located directly above the corresponding breaker. The load returns connect to the return bus, which accommodates 24 two-hole #10-32 lugs on 5/8-inch centers, and four two-hole 1/4"-20 lugs on 3/4-inch centers. The return bus also provides a pair of threaded 3/8"-16 holes on 1-inch centers for connection of a cable to the master station ground. Figure 4.7-1 shows the power plant's DC distribution section with the front cover removed.

Eight GMT fused outputs are also available as an option, and are configured at the factory.

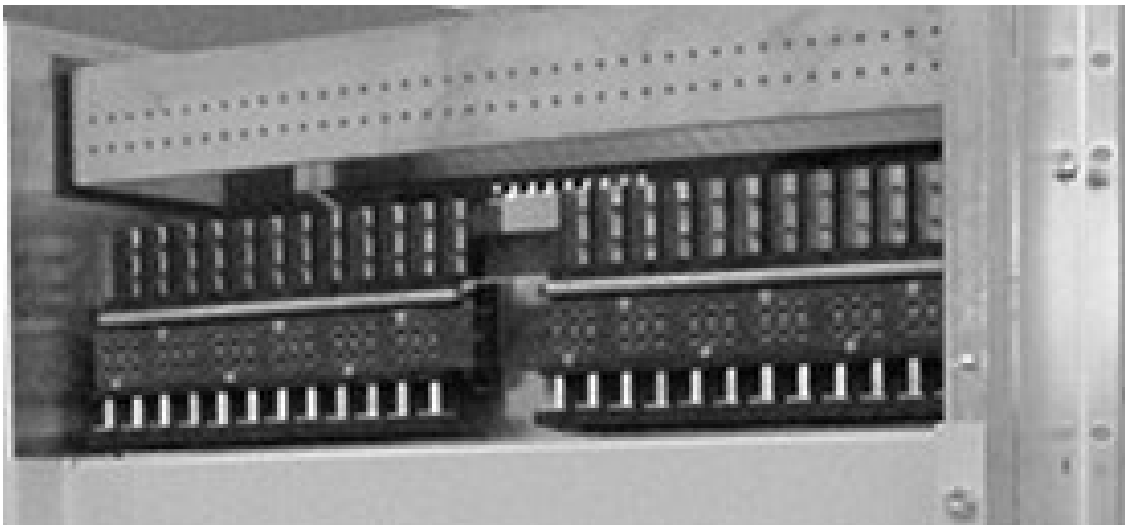


Figure 4.7-1. Upper Tier DC Distribution (Front Cover Removed)

4.8 Mounting

Front mounting on standard 72" or 84" high, 23-inch rails

4.9 Environmental

- Ambient Temperature: -20°C to +65°C (-4°F to +149°F) operating
-40°C to +85°C (-40°F to +185°F) storage
- Humidity: 0% to 85% RH non-condensing operating
0% to 95% RH non-condensing storage
- Altitude: Up to 3000m (9800Ft) operating
Up to 10,000m (32,000Ft) storage

4.10 Mechanical

- Dimensions: 42" high x 23" wide x 20" deep (1066x584x508mm)
- Weight: Housing - 190 lbs. (86kg)
Rectifier - 11 lbs each. (5kg)
- Color: Dawn Gray (fronts)

NOTE: Descriptions & sizes are for the power system alone; when installed with inverters, batteries, etc., dimensions & weight will be affected.

4.11 Compliance

- UL 1950
- NEBS – level 3
- FCC Part 15, Class A

5. INSTALLATION PROCEDURES

5.1 Preparation

5.1.1 Recommended Tools

- Standard selection of insulated hand tools.
- Proper tools for crimping the selected cable lugs.

5.1.2 Recommended Test Equipment

- Digital Multimeter

5.1.3 Equipment Inspection

Remove equipment from packing material and inspect for shipping damage to verify the safety and operational suitability for the installation site. *[Refer to Section 1.3]*

5.1.4 Safety Precautions

***** WARNING *****

The MX28B600 DC power plant is supplied from a nominal 220V AC, 60 Hz source. Keep the AC input enclosure cover in place when the system is operational or energized.

***** WARNING *****

Hazardous energy levels are present on bare conductors in the -48V DC distribution connection area of the plant. While certain engineering precautions have been designed into the system, accidental shorting of distribution conductors can cause arcing and high currents that can cause serious burns or other physical harm.

It is recommended that:

- Any jewelry, rings or watches be removed while working on this equipment.
- Handles of all wrenches, screwdrivers, cutters and pliers be insulated.
- Shafts of screwdrivers must be wrapped in electrical tape or otherwise insulated.

*****WARNING*****

NOTE: OVER TEMPERATURE WILL LEAD TO RECTIFIER SHUTDOWN.

Rectifier fan inlet filters are available for dusty or hostile environments. The filters require periodic cleaning and/or replacement. Monitor filters to determine a maintenance cycle for filter cleaning. Rectifiers will signal OVER TEMPERATURE WARNING and eventually fail if filters are not maintained.

5.1.5 Room/Locations

NOTE: The power plant is designed for installation in a room, vault, or similar enclosure that is accessible only to qualified persons in accordance with NEC or other authority having jurisdiction.

Prior to installation, drawings, floor loading requirements, external alarm points, AC service entrance, and grounding schemes should all be checked and confirmed. If batteries are to be mounted in a room separate from the power plant, careful attention should be paid to battery cable voltage drop effects. Environmental operating temperatures and ventilation/cooling considerations should also be noted, not just for the power system but for all other equipment that may reside in the power room area.

5.1.6 Mounting

Front mounting on standard 23” rails, and/or installation in appropriately vented cabinets is possible.

5.1.7 Ventilation

The rectifiers have fans that provide front to rear airflow for internal cooling. The MX28B600 housing should be installed and/or mounted such that there is free airflow to the front, top, and bottom of the unit. *[Refer to Section 4.9 for environmental characteristics.]*

5.2 AC Service and Ground Connections

***** WARNING *****

Ensure that all of the DC and external AC circuit breakers are in the OFF position prior to connecting service to the power plant. Confirm that all voltages have been removed including any battery sources before proceeding.

The MX28B600 DC power plant requires the supply of 208/220/240V AC, single-phase, 50/60 Hz power through individual external 20-amp two-pole circuit breakers to the AC input terminal block connections for each rectifier in the system. (The AC wiring, from the AC input terminal block connections to the hot-pluggable AC input connector for each rectifier, is factory installed.)

The AC input enclosure, located at the top left rear of the MX28B600 housing, is provided with three one-inch conduit entry holes. Inside, 3 terminal strips for AC input power connection and a separate “Earth Ground” bar for connection of the safety ground wires are provided. The terminal blocks are labeled as Position 1 through Position 4 for shelves 1, 2, and 3 with each position having inputs designated “L1” and “L2” for connection of the two AC wires. Positions 1-4 correspond to the respective rectifier shelf positions from left to right.

The suggested wire size is #10 AWG rated at 90°C or higher; however, the ambient temperature and number of wires in a conduit must also be considered in accordance with NEC requirements. It is suggested that feeds for four rectifiers (8 wires) and one safety ground wire be run in a one-inch conduit; however, be sure to follow any local electrical wiring codes.

If the AC input power is provided from a three-phase distribution panel, the circuit breaker positions should be selected such that the load is balanced as much as possible.

5.3 Battery Connections

An external circuit breaker or fused disconnect (Customer supplied) is recommended in the negative line (located at the battery end of the related cables) to protect the cables from the battery to the MX28B600 DC power plant. The power plant can monitor auxiliary contacts from this breaker.

5.3.1 Cable Sizing Considerations

The battery cable(s) should be sized sufficiently large to limit the voltage drop from the MX28B600 DC power plant to the battery during charging in accordance with system design requirements. The cable(s) must also carry the full load current during battery operation. If assistance is required to determine the necessary cables for the application, contact your sales representative or APC DC Network Solutions Inc.

5.3.2 Connecting the Cables

The battery cable connections are located at the center rear of the unit as shown in Figure 4.6-1. The battery positive (return bus) and battery negative (-48V bus) buses each provide two sets of threaded 3/8"-16 holes on one-inch centers for connecting two-hole battery cable lugs. Connect the battery cables as applicable using 3/8"-16 bolts (not provided) and tighten them with a torque wrench to 200 in-lbs.

***** CAUTION *****

Make certain that the battery polarity is correct when making connections to the MX28B600 DC power plant. Incorrect connection could cause severe equipment damage.

5.4 DC SYSTEM GROUNDING

THE POSITIVE BATTERY CONNECTION (RETURN BUS) FOR THE POWER PLANT MUST BE CONNECTED TO THE MASTER STATION GROUND. THE RIGHT SIDE SECTION (when viewed from the front of the unit) OF THE RETURN BUS PROVIDES A PAIR OF THREADED 3/8"-16 HOLES ON 1-INCH CENTERS FOR CONNECTION OF A TWO-HOLE LUGGED CABLE TO THE MASTER STATION GROUND. DETAILS FOR THIS CONNECTION SHOULD BE PROVIDED IN THE SITE ELECTRICAL GROUNDING PLANS.

5.5 Rectifier Installation

The APC DC Network Solutions Inc. Model MRF28H54BV rectifiers are shipped in separate containers. Follow the procedure below to install a rectifier.

- 1) Remove the rectifier from its shipping container.
- 2) Slide the rectifier into the shelf between the guides until it is fully seated.
- 3) Locate the rectifier retaining screws in the bag the manual came in.
- 4) Fasten the rectifier in place with the rectifier retaining screw.

Since all adjustments are made from the system control unit, no rectifier adjustments are necessary.

NOTE: All "FLOAT" – "BOOST/EQUALISE" switches (one is located on the front of each rectifier in the system) must be set to "FLOAT" to allow the MX28B600 to control the output voltage properly.

5.6 Alarm Connections

The alarm connections for all rectifiers, breakers, and fuses are factory pre-wired. The MX28B600 DC power plant, however, permits the user to program the system alarms in various ways.

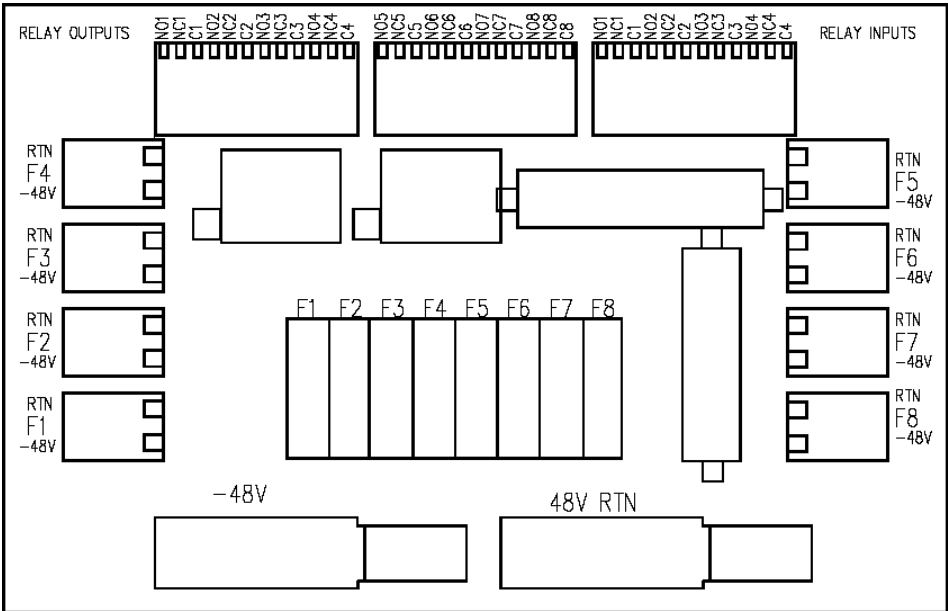


Figure 5.6 Interface Board

5.6.1 External Alarm Inputs

Four external alarm inputs with assignable priority levels are available. These alarm inputs respond to external dry contact closures between normally open (NO) and common (C) or contact openings between normally closed (NC) and C (see Table 5.6-1).

External Alarm Source (non-alarm state)	Connect To Input Alarm Terminals
OPEN	NO-C
CLOSED	NC-C

Table 5.6-1. External Alarm Input Definition

Table 5.6-2 shows the external alarm input connection designations. Connector J4 is located on the interface card mounted in the top left side of the unit. Systems are shipped with jumper wires connecting each NC and corresponding C contact. A jumper wire should be removed only if the corresponding NC-C contacts are going to be used.

EXTERNAL ALARM INPUT	J4 TERMINAL DESIGNATION (NO-NC-C)	USER ALARM NOTES
#1	NO1-NC1-C1	
#2	NO2-NC2-C2	
#3	NO3-NC3-C3	
#4	NO4-NC4-C4	

Table 5.6-2. External Alarm Input Connections

5.6.2 Alarm Outputs

There are eight alarms available that provide outputs via Form “C” relay contacts. The last two of these are pre-assigned as the Minor and Major alarm outputs. The Major relay is energized (NO-C contacts closed) during normal (non-alarm) operating conditions; all the other relays energize when an alarm condition occurs. The other six outputs are initially designated as “Relay 1” through “Relay 6” (the user may assign more meaningful names if desired). The various system alarm conditions can be assigned to any of the eight alarm outputs.

Table 5.6-3 shows the alarm output connection designations. Wago Connectors are located on the interface card mounted in the top left side of the unit. The relay contacts should only be used to switch resistive loads of 0.5 amperes or less at 60 volts or less.

ALARM OUTPUT	TERMINAL DESIGNATION NO-NC-C	USER ALARM NOTES
RELAY #1	NO1-NC1-C1	_____
RELAY #2	NO2-NC2-C2	_____
RELAY #3	NO3-NC3-C3	_____
RELAY #4	NO4-NC4-C4	_____
RELAY #5	NO5-NC5-C5	_____
RELAY #6	NO6-NC6-C6	_____
MINOR	NO7-NC7-C7	_____
MAJOR	NO8-NC8-C8	_____

Table 5.6-3. Alarm Output Connections

5.7 Connecting The Loads

5.7.1 DC Circuit Breakers and Fuses

Both plug-in circuit breakers and GMT fuses can be installed in the MX28B600 power plant for DC distribution circuit protection. Two plug-in circuit breaker tiers, consisting of a 24-position panel (breakers labeled 1 to 24) and two 10-position panels (breakers labeled 25 to 34 and 39 to 48), provide 44 positions of -48V distribution. Available plug-in circuit breakers are shown in table 5.7-1. Plug-in circuit breakers rated at 60A or more require two mounting positions and require a breaker adapter kit, which is included (see kit selection information below the table). The breaker adapter kit includes all necessary mounting hardware.

An optional load shed circuit is available. This option will disconnect any unessential loads from the rest of the system. Loads hooked up to the lower left tier (CB 26-35) will be disconnected. This will preserve the battery run time for essential loads. When hooking up the loads, ensure that they are divided correctly.

BREAKER RATING	PART NUMBER		BREAKER RATING	PART NUMBER
1 A	FFA-0014		40 A	FFA-0020
3 A	FFA-0015		50 A	FFA-0025
5 A	FFA-0016		60 A	FFA-0021-X *
10 A	FFA-0017		70 A	FFA-0022-X *
15 A	FFA-0028		80 A	FFA-0023-X *
20 A	FFA-0018		100 A	FFA-0024-X *
30 A	FFA-0019			

- * -1: adapter has #10 studs on 5/8" centers for two-hole cable lug
 -2: adapter has #10 studs on 3/4" centers for two-hole cable lug
 -3: adapter has 1/4" studs on 1" centers for two-hole cable lug

Table 5.7-1. Plug-in Circuit Breakers

A list of GMT type fuses available from APC DC Network Solutions Inc. is provided in Table 5.7-2.

FUSE RATING	PART NUMBER
1/4 A	FFA-0030
1/2 A	FFA-0031
3/4 A	FFA-0032
1 A	FFA-0033
1 1/4 A	FFA-0039
1 1/2 A	FFA-0035
3 A	FFA-0036
5 A	FFA-0037
10 A	FFA-0038

Table 5.7-2. GMT Fuses

5.7.2 Installation of Circuit Breakers and Fuses

5.7.2.1 Plug-in Circuit Breakers

- 1) Remove the circuit breaker cover panel and the plastic cover(s)/insert(s) from the desired location(s).
- 2) Install the circuit breaker(s) by snapping the top terminal onto the upper bus bar and rotating the unit down until the second terminal snaps onto the breaker termination post as shown in Figure 5.7-1. The breaker alarm terminals are designed to make contact with the alarm terminal board as the breaker is snapped into place.

NOTE: Circuit breaker alarm contacts close when the circuit breaker is tripped but not when it is turned OFF.

***** CAUTION *****

During circuit breaker installation, carefully align the breaker alarm terminals with the alarm terminal board to avoid breaker terminal damage.

- 3) Reattach the circuit breaker cover panel.

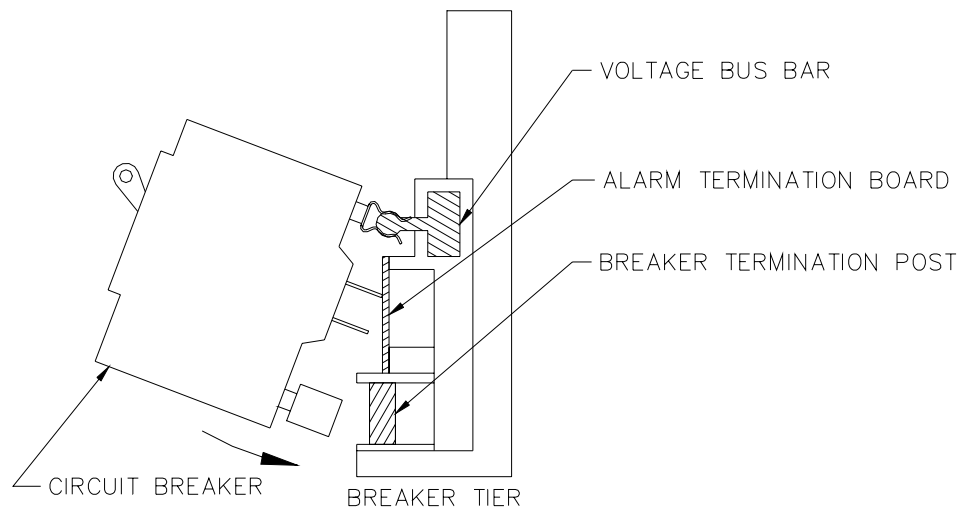


Figure 5.7-1. Installation of Circuit Breakers

5.7.2.2 Optional GMT Fuses

Fuseholders that accommodate GMT fuses are located on the interface card mounted in the top left side of the unit. These fuseholders are only connected to -48V DC if the system has been purchased with the GMT fuse option. This option supplies -48V DC to the fuseholders through

a 50 A. circuit breaker located in circuit breaker Position 1. The interface card provides fuseholders for eight fuses, labeled “F1” through “F8”, which can be used for small -48V DC loads. The maximum fuse size that should be used is 10A.

5.7.3 Load Connections

5.7.3.1 Circuit Breakers

Connections for -48V DC loads require standard two-hole lugs for #10 screws on 5/8” centers and are located directly above the corresponding circuit breaker. The load returns connect to the respective return bus located just above and rearward of the breaker connection points. The upper tier is seen in Figure 4.7-1. The return buses provide a total of 40 sets of threaded #10-32 holes on 5/8” centers and four sets of threaded 1/4”-20 holes on 3/4” centers for connection of two-hole lugs on load return wires.

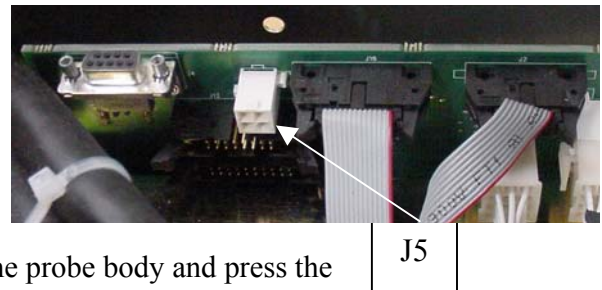
5.7.3.2 Optional GMT Fuses

Connections to the GMT fuses are made at terminal block connectors labeled “F1” through “F8” that are located on the interface card mounted in the top left side of the unit. Each connector has two positions, labeled “-48V” and “RTN”, for connection of the -48V DC load and load return wires.

5.8 Battery Temperature Probe Installation

The optional temperature probe is used to monitor the battery string temperature. To get the most representative temperature measurement, the probe should be placed in contact with a battery cell that is centrally located. The probe should be placed directly in contact with the cell (not the frame surrounding the cell). Generally, the cell cover can be used; be careful not to allow the probe body to touch the terminals.

- 1) Plug the connector end of the temperature probe into J5 the control unit backplane card.
- 2) Route the cable as required to position the probe on the selected battery cell
- 3) Remove the adhesive protection strip from the probe body and press the adhesive side of the probe on the battery cell cover.



5.9 Power-Up and Checkout

Before initiating power-up and checkout, ensure that the following conditions exist:

- 1) Make sure that the external circuit breaker protecting the cables from the battery to the power plant is turned **OFF** (the battery cables should be connected to the power plant, but the battery should **not** be connected).
- 2) Make sure that all load circuit breakers are turned **OFF** (including the one feeding the GMT fuses if the unit has the GMT fuse option).
- 3) Verify that all rectifiers have been installed.

5.9.1 Apply AC Power

Turn on the circuit breakers that supply AC power to the rectifiers in the MX28B600 DC power plant. The main screen should appear on the control unit display (see Figure 5.9-1). The display on the control unit is a 2-lines by 16-characters display. The cursor cycles below the characters of the active selection on the display. Information shown in the second line of Figure 5.9-1 that extends beyond 16 characters (to the right of the “S” in “ALARMS”) can viewed on the control unit display by using the scrolling controls (refer to Section 6 for operation of the control unit).

NOTE: When AC power is initially applied, there is a 60-second period during which no alarms are reported.

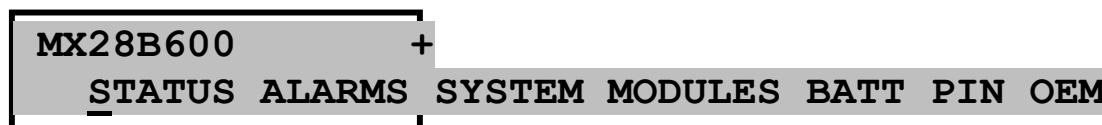


Figure 5.9-1

5.9.2 System Parameters Verification/Adjustment

The MX28B600 system control unit is delivered with pre-programmed parameter default settings. A complete listing and description of all system configuration parameters as well as displayable system status and information is provided in Section 6. Read Section 6 to gain an understanding of and how to use the operational features provided by the MX28B600 DC power plant. As a minimum, the following parameters should be verified and adjusted, if required, before connecting batteries or loads to the power plant:

- 1) **Battery Float Voltage** - default = -54.00V DC (Check the manufacturer's recommendation for the batteries being used in the system.)
- 2) **Battery Maximum Recharge Rate** - default = 50A. (Bellcore specifications recommend a maximum charging rate of capacity (in Ampere-hours) divided by 20 hours; check the battery manufacturer's recommendation.)
- 3) **System Voltage** - measurement \cong -54.00V DC (This is a measurement by the system of the DC output bus voltage.)
- 4) **LVD Option** - default = "Enable" (If the MX28B600 does not have an LVD installed, this should be changed to "Disable".)
- 5) **Rectifier Information** - Check the rectifier information displays to verify that all rectifiers installed can be viewed on the control unit display and that no rectifier alarms are active.

Section 6 provides location information for these parameters and how to make changes if required.

5.9.3 Full System Power Up

To complete a full system power up, perform the following steps

- 1) Turn **OFF** all the circuit breakers that supply AC power to the rectifiers in the MX28B600 DC power plant.
- 2) Turn on the external circuit breaker from the battery to the power plant.

- 3) Turn on all the circuit breakers that supply AC power to the rectifiers in the MX28B600 DC power plant.
- 4) Load circuit breakers may now be turned on as required.

6. SETUP, ADJUSTMENTS, AND OPERATION

6.1 User Interface

The MX28B600 control unit provides a user interface designed with a hierarchical menu that can be viewed on the 32-character display by “navigating” with the “←” (left), “→” (right), “↑” (up), and “↓” (down) arrow keys located on the front panel. The selected item on the display is identified by the cursor cycling beneath its characters.

The “M” (modify) key and the arrow keys are used to set parameters and text to customize the system operation for a specific application. Items that can be modified have “m+” in the upper right corner of the display. (If a security level higher than the one presently set is required to modify the parameter, “s+” is displayed instead of “m+”.) Status, alarms, and information screens have “+” in the upper right corner of the display (or “#” in the case of rectifier information screens) and cannot be modified. When AC power is initially applied, there is a 60-second period during which no alarms are reported.

Pressing the “M” key on the front panel will change the “m+” to “M+”, indicating that the parameter can now be changed using the arrow keys. Some parameters can be changed to other predefined selections by pressing the up or down arrow keys to display an alternative selection. These parameters can be recognized after the “M” key is pressed by the cursor cycling beneath the characters of the selection. For other parameters, such as text and most numeric values, after the “M” key is pressed the cursor will be displayed under an individual character. The right or left arrow key is used to position the cursor below the character to be changed and the up or down arrow key is used to “spin” the digit or letter to the desired value. When the desired changes have been made to an individual parameter screen, the “M” key is pressed again; the “M+” changes back to “m+” and the new entry is stored in memory.

If the user plans to make any changes to system parameters, the first item that should be verified or entered is the appropriate password for the security level required for the parameters to be modified. Security level 2 enables modification of all variable system parameters, level 1 permits modification of some parameters; no security is required for viewing status items. The security level password is entered through the “PIN” screen. If no front panel keys are pressed for 60 minutes, the active password reverts to “0000” and “■APC■” begins to move about the display. Pressing any key returns the display to normal; the password must be re-entered if system parameters require changes.

Eleven LEDs are provided on the front panel of the control unit to indicate system status. Three LEDs grouped together vertically provide overall system status; they are “MAJOR”, “MINOR”, and “NORMAL”, indicating the presence of a major alarm, a minor alarm, or normal operation. The other eight LEDs correspond to the active state of each of the alarm output relays and are labeled “ALM1” • • • “ALM6”, “MIN”, and “MAJ”.

6.2 SNMP interface

In addition, the unit’s controller incorporates a 10-base T Ethernet connection to allow remote access to the system signals, and remote control of certain aspects of its operation. APC’s Manual #991-0181 in the form of a CDRom will allow users to set up interface with the user’s Information Technology System. Simple Network Management Protocol (SNMP) version 1 is supported along with telnet protocol.

6.3 External Alarm Inputs

The four external alarm inputs (also referred to as “Input Relay Alarms”) can be assigned a priority and routed or “mapped” to alarm output relays. Available assignments are “Ignore”, “Major”, “Minor”, and “Relay 1” ••• “Relay 6”. Screens for making the assignments are located at **[SYSTEM/IN-RLY/RLY-MAP]**. A user defined name or “alias” may also be assigned to each of these input alarms. Screens for making these assignments are located at **[SYSTEM/IN-RLY/ALIAS]**. For information on wiring connections to these inputs refer to Section 5.6.1.

6.4 Alarm Output Relays

There are eight alarm output relays designated Relay 1 through Relay 6, Minor, and Major, respectively. Various system parameters may be programmed to activate any of these alarm relays when set thresholds are exceeded or specific conditions occur. The first six relays can also be assigned a priority and routed or “mapped” to other output alarm relays. Available assignments are “Ignore”, “Major”, “Minor”, and “Relay 1” ••• “Relay 6”. Screens for making these assignments are located at **[SYSTEM/OUT-RLY/RLY-MAP]**. This feature makes it possible for a single alarm condition to activate multiple alarm output relays including the Minor or Major alarm relay. A user defined name or “alias” may also be assigned to each of the eight output relay alarms. Screens for making these assignments are located at **[SYSTEM/OUT-RLY/ALIAS]**. For information on making wiring connections to the alarm output relays refer to Section 5.6.2.

6.5 Parameter Locations, Descriptions, and Default Values

The location, description, and factory programmed default value for each of the MX28B600 system parameters is found in The table also shows all of the status and information screens with typical displays. The location of a parameter screen is shown in brackets, for example: **[SYSTEM/IN-RLY/RLY-MAP]**. To find the parameters that can be accessed in this category, starting from the main menu screen, do the following:

- 1) Use the right or left arrow keys to position the cycling cursor below “SYSTEM”.
- 2) Press the down arrow key once.
- 3) Use the right arrow key to position the cycling cursor below “IN-RLY”.
- 4) Press the down arrow key once; the cursor will be cycling below “RLY-MAP”.
- 5) Press the down arrow key (repeatedly if necessary) until the desired parameter screen is displayed (there are eight parameter screens in this category).
- 6) After making any desired changes (refer to Section 6.1 for the procedure), to return to the main menu press the up arrow key repeatedly.

If a parameter requires a level 1 or level 2 security access to permit changes to it, the security level will be found in braces, i.e. {2}, in the “PARAMETER” column of table 6.4.1.

The complete menu structure shown in the order in which it is accessed from the control unit display is presented in outline form in figure 6.4-1 Each indentation to the right represents a menu level below the indicated title.

Table 6.5-1. Parameter Locations, Descriptions, and Default Values

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
SYSTEM SETUP		
Password Entry		
PIN Entry [PIN]	Screen for entry of the active password (PIN).	PIN m+ 0000
Password Setup		
Level 1 PIN {2} [SYSTEM/SETUP]	Password (PIN) that permits security Level 1 parameter changes - limited access.	PIN 1 m+ 1111
Level 2 Password {2} [SYSTEM/SETUP]	Password (PIN) that permits security Level 2 parameter changes - unlimited access.	PIN 2 m+ 2222
OEM Calibration		
OEM R Offset {2} [OEM]	Voltage offset adjustment for factory calibration of voltage readings/settings.	OEM R Offset m+ 0.000 V
OEM R Gain {2} [OEM]	Voltage gain adjustment for factory calibration of voltage readings/settings.	OEM R Gain m+ 1.000 V
OEM S Offset {2} [OEM]	Current offset adjustment for factory calibration of battery current readings/settings.	OEM S Offset m+ 0.0 A
OEM S Gain {2} [OEM]	Current gain adjustment for factory calibration of battery current readings/settings.	OEM S Gain m+ 1.000 A
Site Address/Identification		
Address 1 {1} [SYSTEM/SETUP]	Power plant address or identification - first line.	Address 1 m+ APC
Address 2 {1} [SYSTEM/SETUP]	Power plant address or identification - second line.	Address 2 m+ 11035 Switzer Av
Address 3 {1} [SYSTEM/SETUP]	Power plant address or identification - third line.	Address 3 m+ Dallas, TX.
Control Unit Setup & Info.		
Model {2} [SYSTEM/SETUP]	Model name for the DC power plant. "reset defaults" selection will re-initialize to factory settings for model selected	Model m+ MX28B600
Temperature Scale {1} [SYSTEM/SETUP]	Enables selection of Fahrenheit or Celsius temperature scale (Fahrenheit "OFF" displays readings in °C).	Fahrenheit m+ OFF
Control Unit Revision [SYSTEM/SETUP]	Hardware revision level of the control unit.	Cntrl Rev + 000002
Firmware Version [SYSTEM/SETUP]	Version number of the control unit firmware. NOTE: Actual firmware version number displayed is the current version as of the date of manufacture.	FW Version + 000131

(Table 6.5-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Display Type [SYSTEM/SETUP]	Type number for the control unit display.	Display Type + 000255
Date/Time Setup		
Date {1} [SYSTEM/DATE]	Internal system calendar date.	Date m+ JUN 27 2001
Time {1} [SYSTEM/DATE]	Internal system clock time (24-hour format).	Time m+ 9:00:25
Alarm Threshold Setup		
High Voltage Threshold {1} [SYSTEM/SET-ALM]	System High voltage alarm threshold.	Sys HV Thr m+ -58.00 V
Low Voltage Threshold {1} [SYSTEM/SET-ALM]	System Low voltage alarm threshold.	Sys LV Thr m+ -50.00 V
High Temperature Threshold {1} [SYSTEM/SET-ALM]	Over temperature alarm threshold.	Sys HT Thr m+ 70.0 C
Low Temperature Threshold {1} [SYSTEM/SET-ALM]	Under temperature alarm threshold.	Sys LT Thr m+ 0.0 C
System Status		
System Voltage [STATUS]	System output voltage measured between the MX28B DC power plant -48V and return buses.	Sys Voltage + -54.00 V
System Current [STATUS]	The total system output current (calculated as the sum of the individual rectifier output currents).	Sys Current + 445.8 A
System Temperature [STATUS]	System temperature measured within the control unit.	Sys Temp + 26.7 C
Battery Current [STATUS]	Battery current measured at the current shunt. Will display negative current when Batt is charging, Positive current when Batt is discharging.	Batt Current + -15.0 A
Battery Temperature [STATUS]	Battery temperature measured by the optional battery temperature sensor probe. NOTE: Will read about -156° C with no probe attached	Batt Temp + 25.2 C
System Alarms		
System High Voltage {1} [SYSTEM/SET-ALM]	System voltage is above the high voltage threshold.	Sys HV Alm m+ Minor
System Low Voltage {1} [SYSTEM/SET-ALM]	System voltage is below the low-voltage threshold.	Sys LV Alm m+ Minor
System High Temperature {1} [SYSTEM/SET-ALM]	The control unit temperature is above the high temperature threshold.	Sys HT Alm m+ Minor

(Table 6.5-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Test Relay 1 {1} [SYSTEM/DIAG]	Setting this parameter to “ON” energizes Relay 1 and turns on the “ALM1” LED on the control unit front panel.	Test Relay 1 m+ OFF
• • •	• • •	• • •
Test Relay 6 {1} [SYSTEM/DIAG]	Setting this parameter to “ON” energizes Relay 6 and turns on the “ALM6” LED on the control unit front panel.	Test Relay 6 m+ OFF
Test Minor Relay {1} [SYSTEM/DIAG]	Setting this parameter to “ON” energizes the Minor Relay and turns on the “MIN” LED on the control unit front panel.	Test Min Rly m+ OFF
Test Major Relay {1} [SYSTEM/DIAG]	Setting this parameter to “ON” de-energizes the Major Relay and turns on the “MAJ” LED on the control unit front panel.	Test Maj Rly m+ OFF
BATTERY SETUP		
Float Voltage {1} [BATT/PARAM]	Float voltage at 25°C battery temperature.	Batt Float m+ -54.00 V
Maximum Recharge Current {1} [BATT/PARAM]	Maximum battery recharge current (the system limits the charging current to this programmable value).	Batt Max Rech m+ 50 A
Compensation Method {1} [BATT/COMP]	Activate “000001” or de-activate “000000” battery temperature compensation.	Comp Method m+ 000000
Temperature Compensation {1} [BATT/COMP]	Temperature compensation between low knee and high knee in mV/cell/°C. (Compensation equals zero at 25°C.)	Comp TC m+ - 3.00mV
Compensation High Knee {1} [BATT/COMP]	The temperature compensation high knee is the point above which there is no additional battery voltage compensation for further increases in temperature.	Comp Hknee m+ 40.0 C
Compensation Low Knee {1} [BATT/COMP]	The temperature compensation low knee is the point below which there is no additional battery voltage compensation for further decreases in temperature.	Comp Lknee m+ 0.0 C
Discharge Threshold {1} [BATT/SET-ALM]	An alarm is generated if the battery discharge current exceeds this value.	Batt Disc Thr m+ 10 A
High Voltage Threshold {1} [BATT/SET-ALM]	An alarm is generated if the magnitude of the battery voltage rises above this value.	Batt HV Thr m+ -58.00 V
Low Voltage Threshold {1} [BATT/SET-ALM]	An alarm is generated if the magnitude of the battery voltage drops below this value.	Batt LV Thr m+ -44.00 V
High Temperature Threshold {1} [BATT/SET-ALM]	An alarm is generated if the battery temperature exceeds this value.	Batt HT Thr m+ 70.0 C
Low Temperature Threshold {1} [BATT/SET-ALM]	An alarm is generated if the battery temperature drops below this value.	Batt LT Thr m+ 0.0 C

(Table 6.5-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Battery Alarms		
Discharge Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the battery discharge current exceeds the programmed battery discharge threshold.	Batt Disc Alm m+ Minor
High Voltage Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the magnitude of the battery voltage rises above the high voltage threshold.	Batt HV Alm m+ Minor
Low Voltage Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the magnitude of the battery voltage drops below the low voltage threshold.	Batt LV Alm m+ Minor
High Temperature Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the battery temperature exceeds the high temperature threshold.	Batt HT Alm m+ Minor
Low Temperature Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the battery temperature drops below the low temperature threshold.	Batt LT Alm m+ Minor
RECTIFIER SETUP		
Fail Safe Voltage {1} [MODULES/RECT/PARAM]	Rectifier default output voltage if communication with the control unit fails.	Rect Fail Safem+ -54.00 V
Communications Timeout {1} [MODULES/RECT/PARAM]	The maximum rectifier communications response time allowed before a communications failure is declared.	Rect Fail Comm+ 1 min
Rectifier Information	NOTE: This information can be viewed for each rectifier installed by using the horizontal arrow keys.	
Rectifier Current [MODULES/RECT/INFO]	A display of the DC output current for the individual rectifier.	Rect 1 Curr # 24.9 A
Current Limit Alarm [MODULES/RECT/INFO]	The status will be "ON" if the rectifier has been forced into its current limited mode.	Rect 1 CL # OFF
Standby Alarm [MODULES/RECT/INFO]	The status will be "ON" if the control unit is holding the rectifier in the standby mode.	Rect 1 Stdbby # OFF
Fan Fail Alarm [MODULES/RECT/INFO]	The status will be "ON" if the rectifier fan has failed.	Rect 1 FF # OFF
Rectifier Fault Alarm (RFA) [MODULES/RECT/INFO]	The status will be on if the rectifier output has failed.	Rect 1 RFA # OFF
Rectifier Alarms		
Current Limit Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that a rectifier has been forced into the current limited mode.	Rect CL Alm m+ n of N

(Table 6.5-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Standby Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that the control unit is holding a rectifier in the standby mode.	Rect Stdby Almm+ n of N
Fan Fail Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that a rectifier fan has failed.	Rect FF Alm m+ n of N
RFA Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that a rectifier output has failed.	Rect RFA Alm m+ n of N
CIRCUIT BREAKER SETUP		
Breaker 1 Alias {1} [MODULES/CIRBKR/ALIAS]	An alternate name (alias) that can be assigned to a circuit breaker if desired.	Cir Bkr 1 m+ -48V
• • •	• • •	• • •
Breaker 48 Alias {1} [MODULES/CIRBKR/ALIAS]	An alternate name (alias) that can be assigned to a circuit breaker if desired.	Cir Bkr 48 m+ -48V
Circuit Breaker Alarms		
Breaker 1 Tripped {1} [MODULES/CIRBKR/SET-ALM]	An alarm that indicates Circuit Breaker 1 is tripped.	Cir Bkr 1 Alm m+ Major
• • •	• • •	• • •
Breaker 48 Tripped {1} [MODULES/CIRBKR/SET-ALM]	An alarm that indicates Circuit Breaker 24 is tripped.	Cir Bkr 48 Almm+ Major
FUSE SETUP		
Fuse 1 Alias {1} [MODULES/FUSE/ALIAS]	An alternate name (alias) that can be assigned to a Fuse 1 if desired.	FUSE 1 + -48V
• • •	• • •	• • •
Fuse 16 Alias {1} [MODULES/FUSE/ALIAS]	An alternate name (alias) that can be assigned to a Fuse 16 if desired.	FUSE 16 + -48V

(Table 6.5-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
FUSE Fuse Alarms		
Fuse 1 Blown {1} [MODULES/FUSE/SET-ALM]	An alarm that indicates Fuse 1 is blown.	FUSE 1 Alm m+ Major
• • •	• • •	• • •
Fuse 16 Blown {1} [MODULES/FUSE/SET-ALM]	An alarm that indicates Fuse 16 is blown.	FUSE 16 Alm m+ Major
INPUT RELAY SETUP		
Input Relay 1 Alias {1} [SYSTEM/IN-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	In-Rly 1 m+ Input Relay 1
• • •	• • •	• • •
Input Relay 4 Alias {1} [SYSTEM/IN-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	In-Rly 4 m+ Input Relay 4
Input Relay Alarms		
Input Relay 1 {1} [SYSTEM/IN-RLY/RLY-MAP]	An alarm activated in response to an external contact closure or opening at the Input Relay 1 connection.	In-Rly 1 Alm m+ Ignore
• • •	• • •	• • •
Input Relay 4 {1} [SYSTEM/IN-RLY/RLY-MAP]	An alarm activated in response to an external contact closure or opening at the Input Relay 4 connection.	In-Rly 4 Alm m+ Ignore
OUTPUT RELAY SETUP		
Output Relay 1 Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Out-Rly 1 m+ Relay 1
• • •	• • •	• • •
Output Relay 6 Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Out-Rly 6 m+ Relay 6
Output Relay Minor Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Relay Minor m+ Minor

(Table 6.5-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Output Relay Major Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Relay Major m+ Major
Output Relay 1 Delay {1} [SYSTEM/OUT-RLY/RLY-MAP]	Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated.	Out-Rly 1 Dly m+ 0 sec
• • •	• • •	• • •
Output Relay 6 Delay {1} [SYSTEM/OUT-RLY/RLY-MAP]	Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated.	Out-Rly 6 Dly m+ 0 sec
Output Relay Alarms		
Output Relay 1 {1} [SYSTEM/OUT-RLY/RLY-MAP]	Output Relay 1 alarm can be “mapped” to activate other output relays (“Ignore” activates no additional relays).	Out-Rly 1 Alm m+ Ignore
• • •	• • •	• • •
Output Relay 6 {1} [SYSTEM/OUT-RLY/RLY-MAP]	Output Relay 6 alarm can be “mapped” to activate other output relays (“Ignore” activates no additional relays).	Out-Rly 6 Alm m+ Ignore
LVD SETUP		
LVD1 Trip {1} [MODULES/LVD/PARAM]	LVD1 trip (disconnect) threshold voltage.	LVD1 Trip m+ -42.00 V
LVD1 Restore {1} [MODULES/LVD/PARAM]	LVD1 restore (reconnect) threshold voltage.	LVD1 Reset m+ -48.00 V
LVD2 Trip {1} [MODULES/LVD/PARAM]	LVD2 trip (disconnect) threshold voltage.	LVD2 Trip m+ -42.00 V
LVD2 Restore {1} [MODULES/LVD/PARAM]	LVD2 restore (reconnect) threshold voltage.	LVD2 Reset m+ -48.00 V
LVD Alarm		
LVD1 Option {1} [MODULES/LVD/SET-ALM]	Set to “Enable” if the unit has an LVD1.	LVD1 Option m+ Enable
LVD1 Alarm {1} [MODULES/LVD/SET-ALM]	Sets the priority or “mapping” of an LVD1 Alarm.	LVD1 Open Alm m+ Minor
LVD2 Option {1} [MODULES/LVD/SET-ALM]	Set to “Enable” if the unit has an LVD2.	LVD2 Option m+ Enable
LVD2 Alarm {1} [MODULES/LVD/SET-ALM]	Sets the priority or “mapping” of an LVD2 Alarm.	LVD2 Open Alm m+ Minor

Figure 6.4-1. Control Unit Menu Structure

```

MX28B600      +
STATUS
    Sys Voltage
    Sys Current
    Sys Temp
    Batt Current
    Batt Temp
ALARMS
    Alarm Item 1
    Alarm Item 2
    Alarm Item 3
    Alarm Item 4
    Alarm Item 5
    Alarm Item 6
    Alarm Item 7
    Alarm Item 8
    Alarm Item 9
    Alarm Item 10
    Alarm Item 11
    Alarm Item 12
    Alarm Item 13
    Alarm Item 14
    Alarm Item 15
    Alarm Item 16
SYSTEM
    SET-ALM
        Sys HV Thr
        Sys HV Alm
        Sys LV Thr
        Sys LV Alm
        Rect Cfg Alm
        Rect 1ofN Alm
        Rect 2ofN Alm
        Sys HT Thr
        Sys HT Alm
        Sys LT Thr
        Sys LT Alm
        Hw Sys V Alm
        Hw Batt C Alm
        Hw Batt T Alm
        Hw Sys T Alm
        Hw LVD1 Alm
        Hw LVD2 Alm
    SETUP
        PIN 1
        PIN 2
        Address 1

```

(Figure 6.4-1. Control Unit Menu Structure)

```

Address 2
Address 3
Model
Fahrenheit
Cntrl Rev
FW Version
Display Type
DATE
  Date
  Time
OUT-RLY
  RLY-MAP
    Out-Rly 1 Alm
    Out-Rly 2 Alm
    Out-Rly 3 Alm
    Out-Rly 4 Alm
    Out-Rly 5 Alm
    Out-Rly 6 Alm
    Out-Rly 1 Dly
    Out-Rly 2 Dly
    Out-Rly 3 Dly
    Out-Rly 4 Dly
    Out-Rly 5 Dly
    Out-Rly 6 Dly
  ALIAS
    Out-Rly 1
    Out-Rly 2
    Out-Rly 3
    Out-Rly 4
    Out-Rly 5
    Out-Rly 6
    Relay Minor
    Relay Major
IN-RLY
  RLY-MAP
    In-Rly 1 Alm
    In-Rly 2 Alm
    In-Rly 3 Alm
    In-Rly 4 Alm
  ALIAS
    In-Rly 1
    In-Rly 2
    In-Rly 3
    In-Rly 4
DIAG
  Store Cfg
  Lamp Test

```

(Figure 6.4-1. Control Unit Menu Structure)

```

Test Relay En
Test Relay 1
Test Relay 2
Test Relay 3
Test Relay 4
Test Relay 5
Test Relay 6
Test Min Rly
Test Maj Rly
MODULES
  RECT
    SET-ALM
      Rect CL Alm
      Rect Stdby Alm
      Rect FF Alm
      Rect RFA Alm
    PARAM
      Rect Fail Safe
      Rect Fail Comm
    INFO
      Rect # Curr
      Rect # CL
      Rect # Stdby
      Rect # FF
      Rect # RFA
  CIRBKR
    SET-ALM
      Cir Bkr 1 Alm
      Cir Bkr 2 Alm
      Cir Bkr 3 Alm
      Cir Bkr 4 Alm
      Cir Bkr 5 Alm
      Cir Bkr 6 Alm
      •
      •
      •
      Cir Bkr 70 Alm
      Cir Bkr 71 Alm
      Cir Bkr 72 Alm
    ALIAS
      Cir Bkr 1
      Cir Bkr 2
      Cir Bkr 3
      Cir Bkr 4
      Cir Bkr 5
      Cir Bkr 6

```

(Figure 6.4-1. Control Unit Menu Structure)

Cir Bkr 7
Cir Bkr 8
•
•
•
Cir Bkr 70
Cir Bkr 71
Cir Bkr 72

FUSE**SET-ALM**

FUSE 1 Alm
FUSE 2 Alm
FUSE 3 Alm
FUSE 4 Alm
FUSE 5 Alm
FUSE 6 Alm
FUSE 7 Alm
FUSE 8 Alm
FUSE 9 Alm
FUSE 10 Alm
FUSE 11 Alm
FUSE 12 Alm
FUSE 13 Alm
FUSE 14 Alm
FUSE 15 Alm
FUSE 16 Alm

ALIAS

FUSE 1
FUSE 2
FUSE 3
FUSE 4
FUSE 5
FUSE 6
FUSE 7
FUSE 8
FUSE 9
FUSE 10
FUSE 11
FUSE 12
FUSE 13
FUSE 14
FUSE 15
FUSE 16

(Figure 6.4-1. Control Unit Menu Structure)

```

LVD
    SET-ALM
        LVD1 Option
        LVD1 Open Alm
        LVD2 Option
        LVD2 Open Alm
    PARAM
        LVD1 Trip
        LVD1 Reset
        LVD2 Trip
        LVD2 Reset
BATT
    SET-ALM
        Batt Disc Thr
        Batt Disc Alm
        Batt HV Thr
        Batt HV Alm
        Batt LV Thr
        Batt LV Alm
        Batt HT Thr
        Batt HT Alm
        Batt LT Thr
        Batt LT Alm
    PARAM
        Batt Float
        Batt Max Rech
    COMP
        Comp Method
        Comp TC
        Comp HKnee
        Comp LKnee
PIN
    PIN
OEM
    OEM R Offset
    OEM R Gain
    OEM S Offset
    OEM S Gain

```